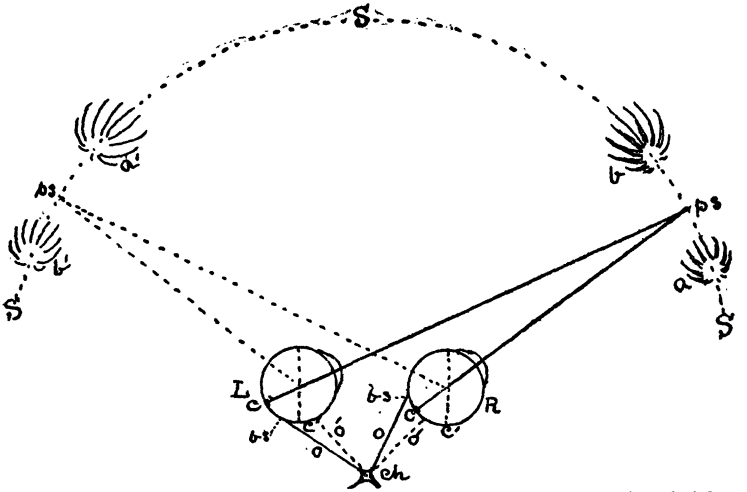
MINOR CONTRIBUTIONS.

ON A CURIOUS VISUAL PHENOMENON.

By Prof. Joseph LeConte.

For some years past I have observed a visual phenomenon which is so conspicuous and even brilliant, that it seems almost incredible that it should have escaped the attention of Physiologists; and yet I do not remember to have seen it mentioned. If it has been already discussed, I should be glad to have my attention called to the fact.[1] The phenomenon of which I speak, however, cannot be observed except when the retina is exceptionally sensitive, *i. e.* after sleeping, and especially on waking up in the morning. I have tried in vain to observe the least sign of it during the ordinary course of the day, or when the retina is in the usual waking condition.



R and *L*, eyeballs turned to the right; *SSS*, spatial concave; *p s*, point of sight; *a* and *b*, circles of bright rays; *o o*, optic nerves; *ch.*, chiasm; *b s*, blind spots; *c c*, central spots. The dotted lines and primed letters = optic axes, lines of sight, optic nerves, central spots, etc., in other positions of the eyes.

[1]Since writing the above, Pres. Hall has called my attention to the fact that the phenomenon is noticed by Helmholtz, (*Optiqne physiologique*, p. 268). But I find the description insufficient and the visual appearance somewhat different from that in my own case.

If on first waking up in the morning, the lids be closed, and the eyes be turned strongly to one side or the other, as if to look at a point on the extreme verge of the visual field, two brilliant circles of radiating lines, surrounding each a blank space, are momentarily seen, one on each side of the point of sight. On turning the eyes strongly in the opposite direction, they again flash out of the dark field on the other side at the moment of extreme strain of the ocular muscles.

The figure represents the eyes turned strongly to the right and directed to the point of sight, *ps*. The brilliant circles are represented by *a* and *b*. I have tried this experiment hundreds, perhaps thousands, of times, and always with the same result, but on account of the flashing momentariness of the appearance, and still more on account of its occurring at some distance from the point of sight (where only, form is accurately given), it is difficult to make an exact picture. What I have given is very nearly what it seems to me.

Such is the phenomenon—what is the explanation? Every appearance in the visual field is, of course, the representative of a corresponding change in the retina. What is the retinal correspondent in this case? I am quite sure it is the *blind spot* or point of entrance of the optic nerve into the eyeball; or, to be more accurate, the blank space from which the bright rays diverge is the representation of the blind spot, and the circle of bright rays represents the retina immediately surrounding it. The cause of the phenomena is this: when the eyeball is violently turned to one side, there is a corresponding strain or pull on the optic nerve, and, moreover, the optic nerve is strongly bent at the point of entrance into the eyeball. In the figure, the dotted lines *o' o'* represents the position and length of the optic nerves when the optic axes are in primary position, as represented also by dotted lines. In turning the eyes to one side, the optic nerves, as may be seen, are both lengthened and strongly bent. The flash of light is produced by the irritation of the bacillary layer immediately surrounding the point of entrance of the optic nerve.

I have said that there are two bright circles, one on each side of the point of sight, one corresponding to each eye. To which eye does each belong? As is well known, the optic nerves enter the eyeballs in the inside or nasal side of the central spots (see figure). But impressions on the nasal halves of the two retinæ are seen doubled *homonymously*. Therefore, of the two bright circles, the one on the right side (*a*) belongs to the right eye, and the one to the left side (*b*) belongs to the left eye. I have found in my experiments that the left-side one (*b*) in looking right, and the right-side one (*a'*) in looking

left, is the more brilliant. The reason of this is easily explained. For, except in looking at a great distance, with the optic axes parallel, it is evident that in looking right it is the left eye that is more turned and the optic nerve more pulled; and in looking left, the right eye and right optic nerve. But again, it will be observed that the rays are not equal in all directions, but stream, as it were, backward from the direction of ocular motion. In looking right, the rays stream to the left, and in looking left, they stream to the right. Now, since all retinal impressions are reversed in position in the field of view, this means that the retinal impression is greater on the right side of the blind spot, in the first case, and on the left side in the second case. In other words, in both cases the stimulation of the retinal rods is greatest on the side *toward which the optic nerve is bent* by the motion of the ball. The stimulation is probably, therefore, more by *crushing* than by *pulling*.

Many attempts have been made to detect some representation of the blind spot in the field of view. In most of these, the expectation seems to have been to find a black spot, or a dark, or dim, or dusky or clouded spot. But such expectation betrays a misconception of the nature of the blind spot. This spot is an *insensitive spot*, and its representative, therefore, is an *invisible spot*, *i. e.*, a spot where objects disappear from view. It cannot be a dark or dusky spot, or a spot of any kind *differentiated from the general field*, for then it would be a *visible spot*, which it is not. As it cannot be differentiated from an even field, like a white wall, or the sky, the *mind* extends the general color of the neighboring field over it. We seek in vain, therefore, to find a visible representation of the blind spot in the field of view. But in the experiment described above, the *place* of the invisible spot, or the spatial representation of the blind spot, is distinctly observed in the dark field. Not that the spot itself is differentiated from the general field, but the parts immediately surrounding the invisible spot are differentiated, both from it and from the general field. We know of no other experiment that brings out clearly the place of this spot.